G07F 3/02B

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in or relating to Coin Processing Devices

I, WILLIAM PATZER, a citizen of the United States of America, of 715 North Kedzie Avenue, Chicago, Illinois, United States of America, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device for processing coins to separate legitimate coins from slugs, washers, counterfeits, and other non-legitimate or spurious coins and/or to separate coins into their various denominations, and for delivery of the legitimate coins of the various denominations from certain portions of the device for use coupled with the rejection of all others. This invention relates more particularly to a coin testing device of the type described for the rejection of non-legitimate or spurious coins as distinguished from legitimate coins which are processed therethrough for use.

Devices of the type described for processing coins to separate the coins introduced into their various denominations and to reject spurious coins as well as coins other than those of the denominations for which the device is designed have heretofore been produced but, to the best of our knowledge, all such devices have relied in operation upon the use of a rocker arm or cradle or similar moving parts to receive the coins during passage through the device for separation thereof into denominations in accordance to size or weight and for delivery of the coins to other sections of the device for further testing to eliminate the spurious from the legitimate coins. Such instrumentality which depends upon movement as well as rate of movement of elements for proper operation becomes ineffective for use in the manner intended when factors arise that interfere with the various movements of the parts. In coin rejectors of the type heretofore produced, such interferences invariably and frequently arise by reason of the accumulation of dirt or other material sometimes intentionally introduced into the device but more often carried into the device with coins or which naturally settle onto the parts of the device from the atmosphere. The movement of parts may also be slowed or frozen into position by other factors, such as corrosion, deterioration or breakage of parts such as springs or weights which influence movement or by destruction of parts which might arise out of mis-treatment of the device in use or the like.

Whatever the reason, failure to operate frequently occurs and it becomes necessary to exchange the device for another and during such period the machine operated in combination with the device becomes incapable of use. In the event that such improper operation can be detected in time, replacement can be effected before permanent damage is inflicted upon the device by others who shake or pound upon the unit in the attempt to force passage of the coin or coins inserted therein and failure to operate discourages the use of dispensing or the like mechanism on which such devices are employed with the result that an improperly operated unit becomes detrimental to the entire industry. In any event, it becomes necessary to replace the unit for repair to the end that maintenance cost becomes rather high.

Instead of eliminating the cause of the difficulty, many operators attempt to overcome sluggishness in movement by lubrication of the parts. While lubrication temporarily improves the operation of the moving parts, the oils introduced soon become mixed with dirt or deteriorate to form a gummy mass which renders the unit thereafter useless and prevents further operation of the dispensing device or the like machine used in combination therewith.

The need for a device capable of operation without reliance upon moving parts has been the goal of the industry for many years and it is an object of this invention to produce a

[*Price 3/6*]

coin processing device of the type described which achieves this goal.

More specifically, it is an object of this invention to produce a coin processing device of the type described which is free of any parts which require movement with the coins during operation, which provides for the movement of coins therethrough in a substantially continuous path and at speeds independent of the age of the unit, the time in service or the presence of dirt or other foreign material which might find its way into the device as an incidence to normal use and which therefore is capable of use over extended periods of time without frequent failure in operation thereby to avoid the dangers of damage in service and provide material reduction in the cost as well as the frequency of maintenance and repair, which is effective for separation of coins into their various denominations and for the separation of spurious coins for rejection and delivery of legitimate coins in their various denominations for further use, which processes the coins rapidly and efficiently thereby to provide for more acceptable use from the standpoint of the user as well as the supplier and which is constructed of less expensive parts which can be more easily and effectively manufactured and assembled into a unit of less cost and more efficient and effective operation.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings in which:—

Fig. 1 is an elevational view of a coin processing device embodying features of this invention with the view taken from the gate side;

Fig. 2 is a fragmentary view in elevation of the device shown in Fig. 1 taken from the opposite side;

Fig. 3 is a fragmentary view in elevation of the portion of the device shown in Fig. 2 taken from the gate side but with the gate removed;

Fig. 4 is a fragmentary view in elevation of the portion shown in Figs. 2 and 3 taken of the gate from the reverse side;

Fig. 5 is a sectional elevational view taken substantially along the line 5—5 of Fig. 1, showing the passage of a coin having the dimension of a 10-cent piece;

Fig. 6 is a sectional elevational view similar to that of Fig. 5 showing the passage of a coin having the dimension of a 5-cent piece;

Fig. 7 is a sectional elevational view similar to that of Fig. 5 showing the passage of a coin having the dimensional characteristics of a 25-cent piece;

Fig. 8 is a perspective elevational view of that portion of the assembled device shown in Figs. 2-7; and

Figs. 9-11 are fragmentary sectional elevational views illustrating factors arising in the processing of coins through the device.

As in most coin testing devices of the type described, it is expedient first to effect a separation of the inserted coins based upon dimensional characteristics into various denominations to simplify and to enable a more effective separation based upon composition. For example, the coins inserted may be processed for separation based upon dimensional characteristics corresponding to a 25-cent piece, a 5-cent piece, and/or a 10-cent piece, or any one or any combination thereof prior to subjecting the separated coins to further tests based primarily upon composition to separate the legitimate coins in that size category from spurious coins to permit passage of the legitimate coins while rejecting such spurious coins. The important features of this invention reside in the means for separation of the coins chiefly in accordance with the dimensional characteristics coupled with the advancement of the separated coins for further testing to reject the spurious coins from the legitimate coins which are allowed to pass on through.

As previously pointed out, separation by size during the early stages of the testing to simplify subsequent tests based upon composition has heretofore relied upon the use of gauges supported on a rocker arm, cradle or the like, which permits passage of all coins of smaller dimension between spaced lugs while coins having dimensional characteristics to be supported on the lugs are separated out and conveyed by the rocker arm or cradle to the runway which leads to subsequent tests such as are based upon composition or the like. It will be apparent that separation based upon the use of a cradle is subject not only to the objections previously described which interfere with movement, but that proper operation necessitates the insertion of coins in timed relation with the movement of the cradle from receiving position to delivery position and return before the next coin can be processed therethrough. As a result, separation in the manner heretofore employed is not only subject to interference and failure in operation but the processing of the coins is necessarily slowed, otherwise the insertion of one coin immediately following another might require processing while the elements are out of position with the result that improper operation and possible jamming of the device might occur.

In accordance with the practice of this invention, these objectionable characteristics, apparently inherent in devices of the type which have heretofore been produced, are substantially completely obviated by means which process the coins for separation in accordance with their denominational characteristics of size for further testing without the

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2 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale

Sheets 1 & 2

Fig.5

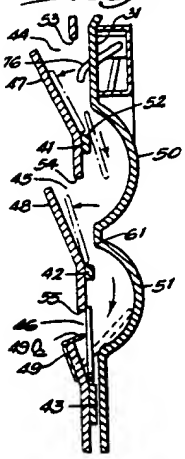


Fig.6

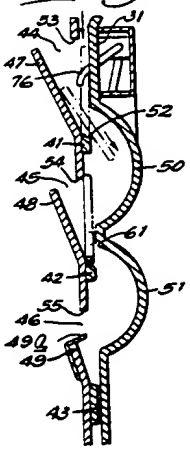


Fig.7

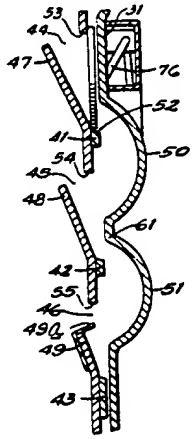


Fig.8

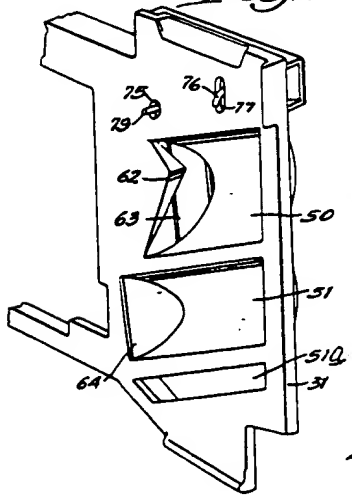


Fig.9

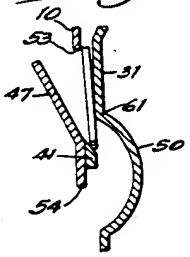


Fig.10

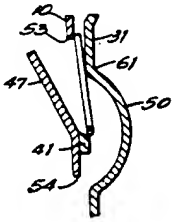
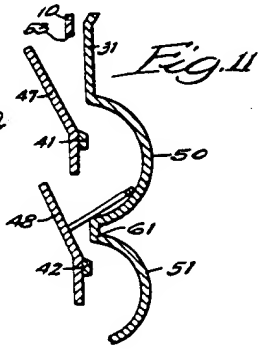


Fig.11



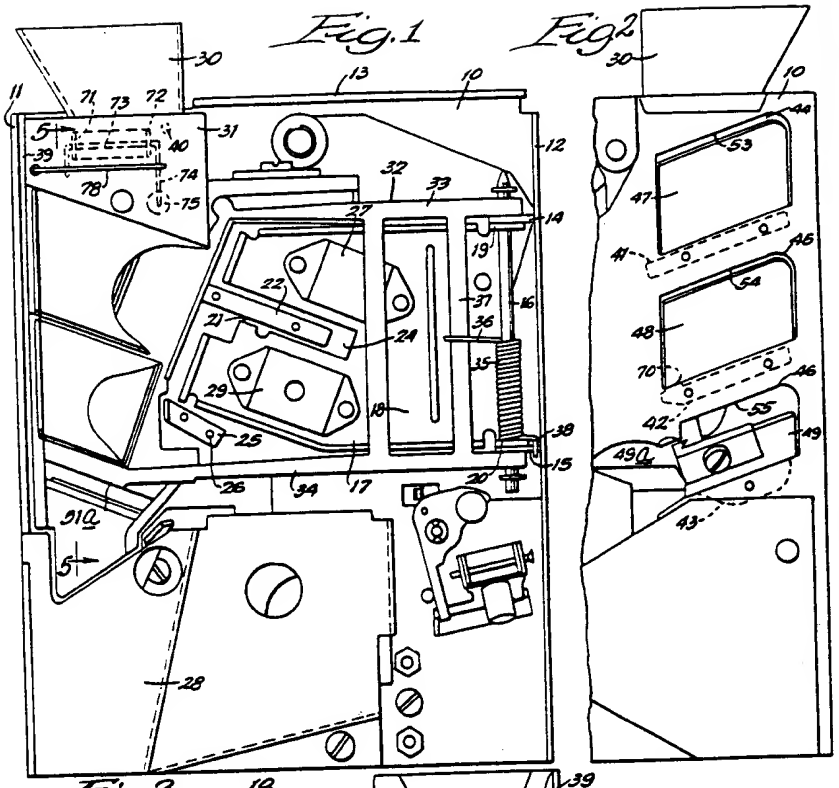


Fig. 1
Fig. 2
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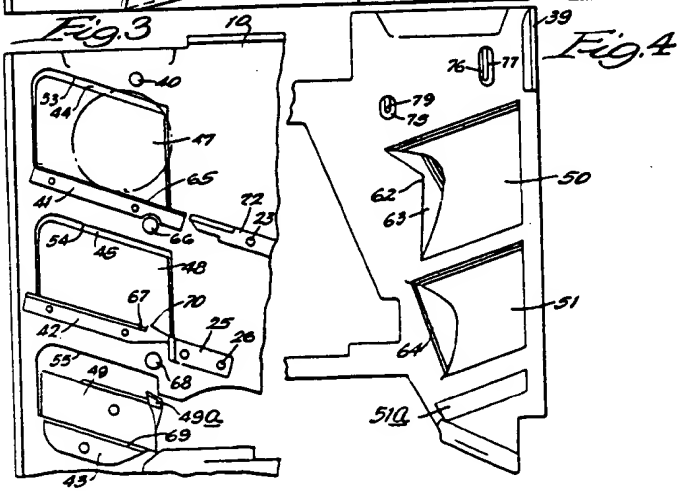
Fig. 3
Fig. 4
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51a
69
43

movement of parts and without the time limitations heretofore imposed by such moving parts so that coins can be processed through the device rapidly and continuously without failure. Since the principal features of this invention reside in the portion of the device by which the coins are initially sorted according to dimensional characteristics and contour, as distinguished from compositional tests, detailed description herein will be made to this portion of the device with brief reference only to the remainder operating in combination therewith. The construction, arrangement and operation of the remainder is usually substantially the same as that heretofore employed in devices of the type described.

Referring first to the general arrangement the illustrated embodiment of a coin testing device comprises a vertically disposed main face plate 10 having its lateral edges turned forwardly substantially perpendicularly from the face plate to provide laterally spaced flanges 11 and 12 and a flange 13 extends forwardly perpendicularly from the upper edge of the face plate from about two-thirds of the length thereof.

The flange 12 has portions struck inwardly to provide a pair of vertically spaced apart, horizontally disposed ears 14 and 15 with aligned openings in a central portion thereof through which a vertically disposed rod 16 extends for pivotally mounting gate members which will hereinafter be described. One gate member 17 pivotally mounted on pin 16 comprises a guide plate 18 having a pair of vertically spaced flanges 19 and 20 extending forwardly from one end thereof with openings for passage of the pin 16 therethrough pivotally to mount the plate for swinging movement between closed and open positions of adjustment. The plate 18 is hinged on pin 16 in a manner to maintain a spaced relation with the face plate 10, when in closed position, as by means of a lug 21 which is turned rearwardly to engage the forward wall of the face plate for maintaining a parallel spaced relation slightly greater than the maximum thickness of coins adapted to be processed through the device.

In the device illustrated, only quarters, nickels and dimes are adapted to pass between the guide plate 18 and the face plate 10 for testing. The quarters which are of larger dimension and separate out first are adapted to travel along an upper path defined by an inclined runway 22 fixed, as by rivets 23, to the front wall of the face plate 10 and for which the guide plate 18 is cut out as at 24 to permit the runway to project therethrough. The nickels, which are of smaller dimension than the quarters but of larger dimension than dimes, constitute the size of coin which is next separated out, as will hereinafter be defined. Coins which have the dimensional characteristics of a nickel are adapted to travel in a path below that of the coins having the dimensional characteristics of a quarter. This path is defined by the lower side of the quarter runway 22 and another inclined runway 25 fixed, as by rivets 26, to the front wall of the face plate 10 is spaced relation below the first runway 22. The nickel runway terminates in advance of that for guiding the coins having the dimensional characteristics of a quarter to define the length of travel along the inclined path.

Permanent magnets are fixed onto the outer walls of the face plate 10 and the guide plate 18 in co-operative relation with each other to set up a magnetic field across the path through which the coins having the dimensional characteristics of a quarter and a nickel pass during travel over the runways 22 and 25 respectively whereby magnetic forces of different scope are generated depending upon the composition of the coins passing between the two plates. For example, in the event that the coin having the dimensional characteristics of a quarter passing between the plates along the upper runway 22 is of a metallic composition which is highly attractive to the magnetic field, the flight of the coin will be arrested in the magnetic field and the coin retained by the magnets 27 between the face plate 10 and the guide plate 17 until scavenged by a sweeping arm which rocks about a pivot in response to actuation of the rejector lever, whereby the scavenger arm rocks about a pivot and sweeps over the face plate 10 positively to displace the arrested coin as the guide plate 17 is rocked about its pivot pin 16 so as to increase the spaced relation between the guide plate and the face plate thereby to permit the spurious coin to be displaced upon engagement for delivery by gravitational force into the reject receiver 28.

In the event that the coin passing through the magnetic field is of a composition which is completely free of any response so that its flight is not retarded, the coin will strike an adjustable deflector lug with such force as will cause the coin to bounce across the device and fall into the reject receiver 28. If, on the other hand, a legitimate 25-cent piece travels over the runway 22 through the magnetic field, the magnetic forces will operate to slow the flight of the coin so that it will pass beneath the deflector lug and will travel along a controlled arc between the lug and an anvil into the chute for receiving legitimate quarters located below the pivoted guide plate 17.

Similar forces and reactions operate to separate spurious from good coins of the size of a nickel which pass along the lower runway 25 through the space between magnets 29 on the guide plate and a similar magnet attached to the opposite wall of the face plate.

When the composition of the coins having the dimensional characteristics of a nickel provide such attraction that the spurious coin is with-held by the magnets in the space between the guide plate and the face plate, the coin is displaced by the scavenger arm as the guide plate is rocked to increase the spaced relation with the face plate, as previously described, so that the spurious coin will be caused to drop into the appropriate reject receiver 28. Contrary to the reactions available from the magnet members operating in the pathway for coins having the dimensional characteristics of a quarter, the magnetic members 29 are adapted to have no effect upon the composition of a legitimate 5-cent piece with the result that the flight of the coin is not arrested as it passes through the magnetic field and legitimate coins strike an anvil with such force as will cause the coin to bounce over the reject slot into the coin receiver for the 5-cent piece. Non-legitimate coins are attracted sufficiently by the magnets to be slowed in flight so that spurious coins miss the anvil and are ultimately deflected for rejection.

The path of the coins from the time that they are inserted into the device through a chute 30 until delivery onto the runways 22 and 25 is limited to between the face plate 10 and a channel plate 31 fixed to the end of and forming a part of a swinging gate 32 having a pair of arms 33 and 34 vertically spaced apart by a distance greater than the vertical dimension of the guide plate 18 which is normally positioned between the arms. The arms 33 and 34 are pivoted at their other ends upon the rod 16 which extends through openings therein and the gate is resiliently urged into normally closed position by means of a coil spring 35 disposed about an intermediate portion of the rod 16 and having one end 36 hooked about a cross bar 37 of the gate while the other end 38 is hooked about the adjacent ear 15. The spaced relation between the channel plate and the face plate, when in normally closed position, is dimensioned to be slightly greater than the maximum thickness of coins adapted to be processed therein so as to permit the free passage of coins vertically therebetween. This spaced relation is achieved by an abutment 39 which extends perpendicularly rearwardly from the upper edge portion of the channel plate and by means of a lug 40 which extends forwardly from the face plate in laterally spaced apart relation from the abutment corresponding to the maximum dimension of coins adapted to be processed through the device.

Thus the spaced relation between the abutment 39 and the lug 40 comprises the first element which limits the dimension of the coins capable of insertion for passage through the device. To the present, the elements described have been employed in devices which have heretofore been produced. The improvements embodying the principal features of this invention reside in the construction of the device through which the coins are processed from the time that they pass beyond the abutment and lug until they are delivered onto the runways 22 and 25 for test based upon composition and the like, as previously described.

Instead of relying upon arresting the movement of coins by spaced lugs on a rocker arm or cradle to separate out coins incapable of passing therebetween and relying upon overbalance provided by the arrested coins to rock the cradle for delivery onto the runways, the use of the cradle or any other moving part for delivery of the coins has been eliminated and the inventive concepts herein rely solely upon the combination of gravitational force and contours of elements in fixed position in the device to effect separation of the coins and delivery thereof to the proper runway for such further tests which are based upon composition and the like.

Description will now be made in detail of the construction of a coin device embodying features of this invention for processing coins of the dimensional order of a 25-cent piece, a 5-cent piece and a 10-cent piece but it will be understood that the features described may be adapted for processing any one or more of such coins or other coins of various denominations without departing from the scope of the invention.

As illustrated in Figs. 5, 6 and 7, the face plate 10 immediately below the laterally spaced apart abutment 39 and lug 40 for limiting passage to coins having the dimensional characteristics of a 25-cent piece or less is provided with three vertically spaced apart, horizontally disposed, inclined runways 41, 42 and 43 which extend from the face plate into the area between the face plate and the channel plate to block passage of coins vertically downwardly between the face plate and channel plate. As will hereinafter be pointed out the spaced relation between the face plate and the channel plate preferably varies depending upon the dimensional characteristics of the coins processed through the particular portion thereof, but generally the spaced relation is greater than the maximum thickness of the coins to about .010 inch greater than the minimum thickness of such coins adapted to pass therebetween. The upper surface of each runway extends more or less as a continuation of the inclined runways 22 and 25 upon which separated coins are supported during passage through the area for testing based upon composition. The face plate 10 immediately above each runway 41, 42 and 43 is formed with elongate slots 44, 45 and 46 respectively and it is further provided with vertically disposed guide

plates 47, 48 and 49 respectively extending upwardly at a backward tilt from the edge of the runway and having lengths corresponding to the lengths of the respective slots with which it is associated. The channel plate 31 is formed with bulbous portions 50 and 51 commencing above and extending downwardly below each of the runways 41 and 42 to provide a spaced relation between the runway and the adjacent portion of the channel plate dimensioned to permit passage of coins downwardly therebetween when the coin is inclined at an angle corresponding to the tilt of the backing plate positioned immediately above the runway. Where coins having a dimension less than that to be separated out upon the runway are not to be displaced downwardly, as in the lowermost section which includes runway 43 and the backing plate 49 for slot 46, a bulbous portion for passage of the coins beyond the runway is unnecessary in the channel section. In the event that coins smaller than that to be separated out on the lowermost runway are to be scavenged directly, the bulbous portion may be replaced by a slot 51ª embodying the dimensional characteristics of the upper portion of the bulbous members for passage of the inclined coins therethrough, as will hereinafter be pointed out.

For use in processing coins such as quarters, nickels and dimes, the upper slot 44 is dimensioned to have a length greater than the maximum diameter of a 25-cent piece and height of the slot or the distance between the upper surface 52 of the runway and the edge portion 53 of the face plate defining the upper edge of the slot 44 is dimensioned to be slightly less than the minimum diameter of a 25-cent piece. The downward flight of coins vertically between the face plate and the channel plate 31 from the inlet between the abutment 39 and the lug 40 is blocked by the upper runway 41. Coins which have a diameter at least as great as the minimum diameter of a 25-cent piece remain substantially vertically disposed upon coming to rest temporarily on the runway 41 because the upper edge of the coin is incapable of clearing the lower edge 53 of the face plate defining the upper edge of the slot. Normal gravitational forces become effective to cause the coin to roll down the inclined runway 42 onto the runway 22 in alignment therewith for passage through the magnetic field for compositional tests and the like. Coins having a diameter less than the minimum diameter for a 25-cent piece will be capable of clearing the edge of the face plate defining the upper edge of the slot 44 upon engagement with the upper surface 52 of the runway 41 with the result that the coin will tip through the slot onto the backing plate 47 for disposition at an angle which enables the coin to pass downwardly between the bulbous portion 50 of the channel plate 31 and the runway 41 into the underlying section for further testing. Thus the coins of one dimension are separated from all other coins either for subsequent testing as described or for other purposes.

Similarly, the intermediate slot 45 is dimensioned to have a length greater than the maximum diameter of a 5-cent piece and the distance between the surface of the runway 52 and the edge portion 54 of the face plate defining the upper edge of the slot 45 is dimensioned to be slightly less than the minimum diameter of a 5-cent piece. Slot 46 is dimensioned to have a length greater than the maximum diameter of a 10-cent piece and the distance between the surface of the inclined runway 43 and the edge portion 55 of the face plate defining the upper edge of the slot 46 is dimensioned to be slightly less than the minimum diameter of a 10-cent piece. Thus, in general, the characteristics of the slotted portion may be defined as having a length greater than the maximum diameter of the coin adapted to be separated out for passage down the runway and as having a distance between the surface of the runway and the portion of the face plate defining the upper edge of the slot less than the minimum diameter of the coin. As a result, when a coin of proper dimension comes to rest upon the runway, the upper edge of the coin will abut the edge portion of the face plate defining the upper edge of the slot so that the coin will be supported upright on the runway and will be incapable of passing vertically downwardly by gravitational force beyond the runway but instead will roll in response to gravitational force down along the runway and onto the runway in alignment therewith for movement of the coin laterally while with coins of smaller dimension, the upper edge will be able to clear the portion of the face plate defining the upper edge of the slot so that the coin will tip through the slot which is of a length incapable of blocking such tilting movement to assume an angle capable of passage over the runway into the area between the runway and the bulbous portion of the channel plate to the section imediately below for further testing.

For proper control, the backing plates 47, 48 and 49 should be tilted at an angle at which the coins tipping through the respective slots and coming into engagement therewith will be incapable of coming to a complete rest since such condition would block the runways and render the device unfit for further use in processing coins. Instead, the angular relation of the backing plate should provide for substantially uninterrupted gravitational movement of such coins downwardly through the slot available between the bulbous portion of the channel plate and the runway into the section therebelow for sub-

sequent testing. For this purpose, it is preferred to form the backing plate with a tilt of about 16-27° with the vertical depending somewhat upon the particular dimensional characteristics of the coin and the slope of the surface of the runways with which the backing plates are associated. For example, the preferred range for a backing plate operating with the slot for separating out coins having the dimensional characteristics of a 25-cent piece is between 23° and 27° with the vertical while the backing plate for the slot for separating coins having the dimensional characteristics of a 5-cent piece is preferably between 19° and 23° and the preferred tilt for the plate positioned behind the slot for separating out coins having the dimensional characteristics of a dime is between 16° and 20°. It will be understood that the angular relationship may be varied very slightly depending further upon the slope of the runway engaged by the coins.

It has also been found that it is desirable for proper operation to slope the runways downwardly from the edge portion adjacent the backing plate to the edge portion adjacent the channel plate and that for most efficient operation it is preferred to maintain the slope of the runways within the range of 105-115° with the vertical. When the slope of the runways is increased beyond 115°, there is a tendency for the coins to become wedged as a result of forces urging the edge of the coins to be displaced downwardly along the slope upon engagement and the force reaction developed at points of contact between the intermediate portion of the coin and the portion 61 of the channel plate immediately above the bulbous portion 50 or 51 and the point of contact between the opposite side of the coin and the overlapped portion of the face plate defining the upper edge of the slot, as indicated schematically in Fig. 9 of the drawings. Such three point contact coupled with the forces existing to pivot the coin about the edge portion 61 of the channel plate introduces a wedge which may prevent normal rolling movement of the separated coin downwardly over the inclined surface of the runway. On the other hand, when the surface of the runway is formed with insufficient slope, there is a possibility that the coin will be able to balance itself in an upright position on the runway so as to be able to roll down the inclined runway even though the coin is of insufficient dimension otherwise to be held upright by the overlapping edge portion of the face plate defining the upper edge of the slot.

Important also is the angular relationship of the bulbous portion and the location thereof both above and below the respective runway. In the event that the bulbous portion 50 or 51 commences at a point too far above the upper surface of the runway, it is possible for the coin ordinarily capable of being separated thereon to assume an angular position, as illustrated in Fig. 10 of the drawings, which enables the lower end portion of the coin to clear the runway 41 for passage downwardly notwithstanding the dimensional characteristics of the coin which would otherwise provide for lateral displacement upon separation. Such undesirable characteristics are obviated by maintaining the vertical spaced relation between the upper surface of a runway and the edge portion 61 of the channel plate defining the upper edge of the bulbous region to less than one-half the diameter of the coin adapted to be separated out on the runway which in the case of systems for use in the separation of 25-cent pieces is preferably about 17/64 inch and about 3/16 inch for coins having the dimensional characteristics of a 5-cent piece, and the like.

Important also in this respect to minimize angularity of the coin adapted to be separated is the spaced relation between the parallel wall portions of the face plate and the channel plate, which for most efficient operation decreases from about 0.085 inch between the walls above the quarter runway to about 0.065 inch between the walls below the runway upon which coins having the dimensional characteristics of a 10-cent piece are adapted to be separated. In general, it is desirable that the spaced relation between the parallel portions of the walls of the channel plate and of the face plate be from .010-.015 inch greater than the thickness of the coin adapted to be separated out in the particular portion of the device.

While the spaced relation between the walls of the face plate and the channel plate and the spaced relation between the upper surface of the runway and the edge of the channel plate defining the upper edge of the bulbous portion is adapted to maintain the coins in upright position between the plates for measurement, the angular relationship between the lower portion of the bulbous sections 50 and 51 and the corresponding backing plates 48 and 49 associated with the lower portions thereof is adapted to deposit the coins passing therebetween at an angle which prevents the coins from coming to rest, as illustrated in Fig. 11 of the drawings. It is preferred to maintain an angular relationship between the surfaces which not only provides for continuous movement of the coin downwardly through the device but at an angle which will deposit the coins in an upright position on the runway below for proper testing as to size in the manner described.

For such purposes, it is desirable to vary the angular relationship between the parts depending upon the size of the coins adapted to be processed therebetween. In an upper section through which coins having the dimensional characteristics of a 5-cent piece or

less are adapted to be processed after separation of quarters therefrom. the angular relationship of a nickel at rest on the lower walls of the bulbous portion at the time that its lower edge is in substantial contact with the backing plate. as illustrated in Fig. 11. is preferably calculated to be within the range of 49-55°. in the dime section where coins of smaller dimension are available for processing. the angular relationship developed is preferably maintained within the range of 48-55°. etc. To benefit movement of the coins to an upright position upon passage downwardly into engagement with the underlying runway. it is desirable to form the channel plate with curvilinear corner sections at the ends of the bulbous portions. preferably on a radius of about 1/8-1/4 inch.

It will be apparent from the foregoing that the slotted portion between the surface of the runway and the portion of the channel plate defining the upper edge of the bulbous portion is controlling in the passage of coins therebetween which are reclined at the angle corresponding to that of the backing plate with the result that the upper section of the bulbous portion does not enter materially into the operation of the device and may as well constitute a cutout portion but the lower two-thirds of the bulbous portion is necessary for engaging the lower edge of the oncoming coin to reverse the angular relationship in guiding same onto the backing plate beneath the upper runway for returning the coin to upright position for measurement. While it is best to form the bulbous portion with the curvilinear contour described. the device may be operated successfully when. instead of a bulbous portion. vertically disposed plates inclined at the desired angle with respect to the backing plates are provided.

The angle of inclination of the runways is not critical so long as the incline is sufficient to cause the coins separated out on the surfaces thereof to roll down the incline freely in response to gravitational force. For all practical purposes. an incline of 108° with the vertical has been found to be sufficient. It is preferred to avoid the use of such steep inclines as would interfere with the flip-flop movement of the coin downwardly through the passages or engage them to roll down the steep incline: as a result it is preferred to make use of inclines of less than 115° with the vertical and greater than 105°. The slotted portions are formed with similarly inclined upper and lower edges and with substantially vertically disposed lateral edges whereby the slotted portions substantially define parallelograms.

There is a tendency of the coins upon engagement with the inclined runways to be displaced laterally in the direction down the incline notwithstanding displacement of the coins off the runway for passage to sections below for testing. Such lateral displacement makes available the possibility that the coins upon engagement with the runway below will be incapable of passage through the slot even if of small dimension because the slot might terminate at a point before that to which the lateral edges of the coin extend. To avoid this possibility. the device is provided with a deflector plate 62 or the walls of the bulbous portions are otherwise contoured to displace the coins in contact therewith in the direction opposite the incline of the runway so that substantially the full length of the slot below will be available for testing the dimensional characteristics of the coin. as described.

Such lateral displacement of the coin toward the forward edge of the slot is also effected in part by formation of a curvature 63 which is concave as seen in Fig. 1 on the bulbous portion adjacent the lower end except for the bulbous portion above the last runway constructed to block further movement of the coins. In this portion. the curvature at the end 64 of the bulbous portion is convex instead of concave to permit the coin to tilt to the fullest extent i.e. to the position shown in Fig. 11 throughout the length of the slot and backing plate for entrapment in the event that the coin has dimensional characteristics other than that adapted to pass down the runway.

To prevent passage of coins having dimensional characteristics greater than that for the coin to be separated out for passage down the respective runway. the lug 40 is spaced upwardly from the surface 65 of the end portion of the runway by a distance slightly greater than the maximum diameter of a 25-cent piece. Another lug 66 extending forwardly from the face plate is spaced from the surface of the end portion 67 of the runway 42 by a distance slightly greater than the maximum dimension of a 5-cent piece and lug 68 is spaced upwardly from the surface of the end portion 69 of the runway 43 by a distance slightly greater than the maximum dimension of a 10-cent piece. To slow the movements of the coins during passage through the region between the lugs and the runways. the runways may be formed with a protuberance or offset 70. The offset functions in addition to achieve separation of coins passing down the runway in accordance with weight since coins having a specific gravity less than that of legitimate coins of equivalent dimension may be incapable of passage over the hump and will be retained thereby until rejected. as previously described.

An additional preliminary test for elimination of coins having dimensional characteristics differing from that of the coins adapted to be advanced down a particular runway or having surface characteristics which differ

such as having openings in the form of washers, slugs, and the like, is illustrated in the drawing in the area through which coins having the dimensional characteristics of a 25-cent piece are adapted to travel.

As illustrated in Fig. 1, and in Figs. 5, 6, 7 and 8 of the drawings, a pair of laterally spaced ears 71 and 72 extending upwardly from the front wall of the channel plate on the gate portion 31 are formed with aligned openings having an intermediate portion 73 of an elongate wire member extending therethrough. One end portion 74 of the wire member extending beyond one ear is turned to extend downwardly and then rearwardly through an opening 75 in the channel plate through the space between the channel plate and the face plate and into the slotted opening adjacent the lower end thereof. The other end portion of the wire member extending beyond the other ear is turned angularly rearwardly and down with a curvilinear end portion 76 normally extending through an opening 77 in the channel plate into the space between the face plate and the channel plate in the path of the coins falling gravitationally through the inlet between the abutment 39 and the lug 40. The wire member is adapted freely to rock about the axis formed along the intermediate portion 73 extending through the openings in the ears 71 and 72 to between a normally extending position wherein both of the end portions project into the space between the plates and to a retracted position wherein both of the end portions are displaced forwardly out of the path of the coins moving through the space between the plates. Means such as a leaf spring 78 having a free end bearing against the downwardly extending arm 74 while the other end is anchored onto the gate operates resiliently to urge the ends toward the normal or extended positions. The spaced relation between each of the projecting end portions 79 and 76 is dimensioned to be slightly less than the minimum diameter of the coins adapted to be separated out on the runway immediately therebelow.

As a coin passes downwardly from the inlet, the curvilinear end portion 76 lying in the path of the coin is engaged by the lower edge of the coin and cammed forwardly out of the path of the coin. The other end portion 79 of the wire member is concurrently retracted from the space between the channel plate and the face plate to enable free movement of the coin therebetween. If the coin is of a solid construction and dimensioned to correspond to a 25-cent piece, the curvilinear end portion will continue to be engaged for displacement to the retracted position until the leading edge of the coin blocks the other opening 75 to prevent return of the member to normal position even after the curvilinear portion 76 is released so that no interference will be had to the movement of the coin down the runway. If, on the other hand, the coin is of smaller dimension than a 25-cent piece, the trailing edge of the coin will clear the curvilinear end portion 76 of the wire holder before the leading edge portion of the coin blocks the opening 75 to prevent return of the other end 79 to blocking position. As a result, the ends will return to normal position to confine the coin therebetween and prevent its further movement down the runway. Similarly, if the coin has holes or openings, the end portion 79 will be capable of return to blocking position through openings in the coin which might come in registry therewith after the trailing edge of the coin has cleared the curvilinear end 76 thereby to hold up such spurious or counterfeit coins which are released upon rejection.

The construction of the device will be further evident from description as to the operation for testing coins of various dimensions as hereinafter set forth.

Normally the device is mounted in an upright position on a dispensing machine or the like with the good coin receivers beneath the lower edge portion into which the legitimate coins or particular denominations are delivered by the device while the reject receiver is located beneath the reject end of the unit. Coins are inserted into chute 30 which leads to the slot between the abutment 39 and the lug 40 at the upper inlet end between the face plate and the channel plate on the gate.

All coins incapable of passing through the slot because of dimension are retained by the abutment and lug until the reject lever is operated which swings the gate 32 about the pivot rod 16 away from the face plate to increase the spaced relation between the face plate and the channel plate whereby the separated coin falls downwardly into the receiver for rejection.

All other coins having dimensional characteristics less than the spaced relation between the abutment and the lug and having a thickness less than the spaced relation between the face plate and the channel plate automatically drop downwardly into the preliminary test area for separating the coins by dimensional characteristics as well as weight and other physical properties. As the coin or coins pass downwardly from the inlet, the end portion of the wire clip is cammed out of the path upon being engaged by the coin to enable the coin to fall vertically by gravitational force between the face plate and the channel plate until the lower edge of the coin engages the surface of the first and uppermost runway lying in its path.

If, upon engagement, the upper edge portion of the coin is incapable of clearing the lower edge portion of the face plate defining the upper end of the slot, the coin will be retained in its upright position on the runway.

as illustrated in Fig. 7, and gravitational force will become effective to cause the coin to roll downwardly along the inclined runway onto the runway 22 in alignment therewith and over which the coin continues to roll during passage to subsequent areas for test based upon composition. If the coin rolling down the runway is smaller than coins of the particular size to be separated out or if it has certain kinds of openings, the end 79 of the wire clip will be urged to return to its normal blocking position through the opening 75 when the trailing edge portion of the coin clears the curvilinear end 76 of the clip. If, on the other hand, the coin has dimensional characteristics which are larger than the minimum to be separated out, the lug 40 will block movement of the coin down the runway, particularly if a step, such as the offset 70, is present to slow the flight of the coin and to enable more accurate calibration therebetween.

By this first section, all coins having certain minimum and maximum dimensional characteristics such as that for a 25-cent piece will be separated from the remainder for passage laterally down the runway for further tests based upon composition or the like or for other suitable purposes. Other coins of lesser dimension will either be stopped by the wire clip as described or else the upper edge of the coins will be able to clear the lower edge portion of the face plate defining the upper edge of the slot as the downward flight of the coin is arrested on the runway. As a result, the coins of smaller dimension will tip through the slot at an angle depending upon the backing plate to enable passage of the coin in reclined position through the slot between the runway and the bulbous portion of the channel plate, as illustrated by the coin in broken lines in Fig. 6.

As the coin of smaller dimension passes downwardly by gravitational force between the first runway 41 into the area below, the leading edge of the coin engages the lower curvilinear end portion of the bulbous member 50 to reverse the inclination of the coin for engagement with the intermediate portion of the second backing plate 48 which then co-operates with the curvilinear edge 61 of the channel plate to straighten the coin prior to or upon engagement with the second runway so as to enable measurement thereof for separation. If the coin has undesirably been shifted inwardly in response to contact with the inclined runway above or for other reasons, the coin is deflected laterally during such passage by the offset 62 provided in the path thereof during passage through the bulbous portion.

In the event that the upright coin supported on the second runway 42 extends beyond the lower edge portion of the face plate defining the upper edge of the slot, the coin then remains upright, as illustrated by solid line in Fig. 6, and gravitational force becomes effective to cause the coin to roll laterally down the inclined runway onto the runway leading into the area for further tests of the coin of that particular size as previously pointed out.

If, by chance, coins of larger dimension find their way into this section, the flight down the runway is blocked by lug 66 and calibration thereof is enhanced by the offset 70 over which the coin rolls down the runway to slow the passage of the coin and also to enable separation by weight in the event that the specific gravity of the metal is insufficient to carry the coin over the hump.

All other coins of smaller dimension which are able to clear the lower edge portion of the face plate defining the upper edge of the slot 45 tip through the slot onto the backing plate 48 to assure an angle which enables the coins to be displaced by gravitational force through the slot between the runway 42 and the bulbous portion 51 for downward flight into the section below for testing, as illustrated by the coin in broken lines in Fig. 5. The angular relationship between the bulbous portion, the lower edge thereof and the backing plate functions to guide the coin down the downward flight to an upright position when arrested in flight by the last runway 43 for testing. If the coin is of a dimension which projects beyond the lower edge portion of the face plate defining the upper edge of the slot 56 when resting upon the runway, the coin will remain upright on the runway, as illustrated by the coin in solid lines in Fig. 5. Gravitational force will operate to cause the coin to roll down the runway for use or for further testing.

If the coin is greater in dimension than that which is intended to be separated out in this section, such as when adapted to separate out dimes from such coins as include pennies and the like, which are able to pass downwardly from the second test section, then the coins of larger dimension, such as the 1-cent piece, will be incapable of passing between the lug 68 and the runway portion 69 and will be held up at this point until rejected upon operation of the reject lever. All other coins will pass through into the section for further testing, as previously described. In the event that the coins are of smaller dimension and are able to clear the face plate for tilting through the slot, the coins may be allowed to remain tilted so that they will be held within the slotted portion and blocked by the arm 49a extending forwardly from the inner and upper edge of the backing plate 49 or by the edge of the face plate defining the lateral edge of the slot until rejected. Instead, a bulbous portion or a slot 51a may be provided for passage of the tilted coin down through for further testing or for de-

positing the coin into the reject receiver.

It will be apparent from the description that the last section may be used alone to achieve separation of one coin from another or that any combinations of such sections may be employed for separating a certain sequence of coins for separation or for testing.

It will be understood that the elements described may be reversed. Instead of forming the slots and the backing plates in the face plate, these elements may be located in the channel plate, with the bulbous portions and other elements associated therewith in the face plate without changing the operation of the device.

It will be apparent from the foregoing that we have produced a coin testing device which, for the first time, does not rely upon any moving parts for operation. As a result, the limitation characteristics of devices of the type described which have heretofore been employed are substantially completely eliminated. The presence of dirt has little, if any, effect on the operational characteristics or upon the efficiency in operation of the device. Coins can be processed through the device in rapid order without jamming and without interfering with the separation of the coins into the various denominations coupled with the rejection of spurious coins.

It will be evident further that the construction of a device embodying the new and novel feature of this invention provides for greater simplification in manufacture and use as compared to similar devices which have heretofore been produced. The number of parts required for assembly is markedly reduced and the various contours and openings of the plate members described can be formed expediently by a stamping operation or the like. As a result, variables between devices with respect to operation and results are substantially completely eliminated thereby greatly to minimize failures in operation.

The improvements in operational characteristics coupled with freedom from interference in use greatly enhances the employment of devices of the type described with coin machines, coin changers, coin separators and other coin operated or vending machines without the high cost of maintenance and without the necessity for frequent replacement which is characteristic of units which have heretofore been employed.

WHAT WE CLAIM IS:—

1. In a coin testing device, a pair of vertically disposed plates having a spaced relation therebetween dimensioned to permit free passage of coins downwardly therebetween, vertically spaced apart downwardly inclined runways having a surface beveled downwardly in the direction towards one of the plates and positioned between the plates in the path of the coins passing downwardly therebetween, the other of said plates having substantially vertically aligned openings extending upwardly from the surfaces of the runways dimensioned to have a length greater than the maximum diameter of coins adapted to be separated out on the corresponding runway and a height slightly less than the minimum diameter of the coins adapted to be separated out on the respective runway, a backing plate for each opening extending upwardly and outwardly from the surface of the runway in the direction away from the one plate, the one plate having substantially vertically aligned portions deformed outwardly in the direction away from the other plate between each backing plate from a distance above the runway which is less than one-half the diameter of the coin adapted to be separated out on said runway to a distance above the runway beneath which is greater than the distance defining the start of the deformed portion for the latter runway, and means for displacing one plate in the direction away from the other to increase the spaced relation therebetween to enable coins which have been held up on the runways to fall downwardly therebetween.

2. In a coin testing device, a pair of vertically disposed plates having a spaced relation therebetween dimensioned to permit free passage of coins downwardly therebetween in response to gravitational force, vertically spaced apart downwardly inclined runways having a surface beveled downwardly in the direction towards one of the plates and positioned between the plates in the path of coins, the other of said plates having substantially vertically aligned slots extending upwardly from the surfaces of the runways dimensioned to have a length greater than the maximum diameter of coins adapted to be separated out on the corresponding runways and a height slightly less than the minimum diameter of the coins adapted to be separated out on the runways, a backing plate for each slot extending upwardly and outwardly from the lower edge of the slot in the direction away from the one plate, the one plate having substantially vertically aligned portions thereof deformed outwardly to provide bulbous regions between each backing plate extending from a distance above the runway therebetween which is less than one-half the diameter of coins adapted to be separated out on the runway to below the runway, and means for displacing one plate in the direction away from the other to increase the spaced relation therebetween to enable coins which have been held up on the runways to fall downwardly therebetween.

3. In a coin testing device, a pair of vertically disposed parallel plates having a spaced relation therebetween dimensioned to range from slightly greater but less than 0.015 inch to about 0.015 inch greater than the

thickest of the coins adapted to be processed through the area therebetween, vertically spaced apart downwardly inclined runways having a surface beveled downwardly in the direction towards one of the plates and positioned between the plates in the path of coins, the other of said plates having substantially vertically aligned slots extending upwardly from the surfaces of the runways dimensioned to have a length greater than the maximum diameter of coins adapted to be separated out on the corresponding runways and a height slightly less than the minimum diameter of the coins adapted to be separated out on the runways, a backing plate for each slot extending upwardly and outwardly from the lower edge of the slot in the direction away from the one plate, the one plate having substantially vertically aligned portions thereof deformed outwardly to provide bulbous regions between each backing plate extending from a distance above the runway therebetween which is less than one-half the diameter of coins adapted to be separated out on the runway to below the runway, and means for displacing one plate in the direction away from the other to increase the spaced relation therebetween to enable coins which have been held up on the runways to fall downwardly therebetween.

4. In a coin testing device, a pair of vertically disposed plates having a spaced relation therebetween dimensioned to permit free passage of coins downwardly therebetween in response to gravitational force, vertically spaced apart downwardly inclined runways lying in the path of the coins passing downwardly between the plates and having a surface beveled downwardly toward one of the plates at an angle of 105-115° with the vertical, the other of said plates having substantially vertically aligned slots extending upwardly from the surfaces of the runways dimensioned to have a length greater than the maximum diameter of coins adapted to be separated out on the corresponding runways and a height slightly less than the minimum diameter of the coins adapted to be separated out on the runways, a backing plate for each slot extending upwardly and outwardly from the lower edge of the slot in the direction away from the one plate, the one plate having substantially vertically aligned portions thereof deformed outwardly to provide bulbous regions between each backing plate extending from a distance above the runway therebetween which is less than one-half the diameter of coins adapted to be separated out on the runway to below the runway, and means for displacing one plate in the direction away from the other to increase the spaced relation therebetween to enable coins which have been held up on the runways to fall downwardly therebetween.

5. In a coin testing device, a pair of vertically disposed parallel plates having a spaced relation therebetween dimensioned to permit free passage of coins downwardly therebetween in response to gravitational force, vertically spaced apart downwardly inclined runways between the plates in the path of the coins passing downwardly therebetween and having a crosswise slope extending downwardly from one edge to the other of about 105-115° with the vertical and a lengthwise incline of between 105-115° with the vertical, one of said plates adjacent the upper edge of the slope having substantially vertically aligned slots extending upwardly from the surfaces of the runways and dimensioned to have a height slightly less than the minimum diameter of the coins adapted to be separated out on the runway and a length greater than the maximum diameter of coins adapted to be separated out on the runways, a backing plate for each slot extending upwardly and outwardly from the lower edge of the slot in the direction away from the other plate, the other plate having substantially vertically aligned portions thereof deformed outwardly to provide bulbous regions between each backing plate extending from a distance above the runway therebetween which is less than one-half the diameter of coins adapted to be separated out on the runway to below the runway, and means for displacing one plate in the direction away from the other to increase the spaced relation therebetween to enable coins which have been held up on the runways to fall downwardly therebetween.

6. A coin testing device as claimed in Claim 2 in which the backing plates are disposed at an angle of 16-27° with the vertical.

7. A coin testing device as claimed in Claim 2 in which the backing plates are disposed at an angle of 16-27° with the vertical and the taper in the surface of the runways corresponds to an angle within the range of 105-115°.

8. A coin testing device as claimed in Claim 2 in which the bulbous portion between the backing plates is formed with a curvilinear bottom wall portion dimensioned to provide an angular relationship of coins disposed thereon in contact with the underlying backing plate at an angle of 48-55° with the vertical.

9. In a coin testing device, a pair of vertically disposed parallel plates having a spaced relation therebetween dimensioned to permit free passage of coins downwardly therebetween in response to gravitational force, vertically spaced apart downwardly inclined runways between the plates in the path of the coins passing downwardly therebetween having a crosswise slope of from 105-115° with the vertical extending downwardly from

one edge to the other, one of said plates adjacent the upper edge of the slope having substantially vertically aligned slots extending upwardly from the surface of the runways dimensioned to have a length greater than the maximum diameter of coins adapted to be separated out on the runway and a height slightly less than the minimum diameter of the coins adapted to be seperated out on the respective runway, the other plate having substantially vertically aligned portions displaced outwardly in the direction away from the first plate between the backing plates from a distance above the surface of the runway which is less than one-half the diameter of the coin adapted to be separated out thereon to below the runway, lugs on one of the plates projecting inwardly into the space between the plates and spaced upwardly from the runways by a distance slightly greater than the maximum diameter of coins adapted to be separated out on the runway, and means for displacing one plate in the direction away from the other to increase the spaced relation between the plates for enabling coins which have been held up on the runways to fall downwardly therebetween.

10. A coin testing device as claimed in Claim 2 in which a deflector plate is provided in the bulbous portions to displace coins passing downwardly therethrough in the direction opposite the lower end of the downwardly inclined runways.

11. A coin testing device as claimed in Claim 2 in which the bulbous portions other than the lowermost are formed with a concave contour in the lower end portion thereof and in which the lowermost bulbous portion is formed with a convex contour in the lower end portion thereof.

12. In a coin processing device, a pair of vertically disposed plates having a spaced relation therebetween dimensioned to permit free passage of coins downwardly therebetween in response to gravitational force, a downwardly inclined runway having a beveled surface extending downwardly in the direction toward one of the plates and located between the plates in the path of the coin, the other of said plates having a slot extending upwardly from the runway dimensioned to have a length greater than the maximum diameter of coins adapted to be separated out on the runway and a height dimensioned to be slightly less than the minimum diameter of coins adapted to be separated out on the runway, a backing plate extending angularly upwardly from the lower edge of the slots in the direction away from the one plate for engagement of coins which tilt through the slot, said one plate having a portion displaced outwardly away from the first plate dimensioned to have a length corresponding to the length of the slot and extending from above the runway by an amount less than one-half the diameter of the coins adapted to be separated thereon to below the runway to provide a slotted portion between the runway and the other plate which permits passage of coins endwise therethrough when disposed at the angle corresponding to the slope of the backing plate and means for displacing one plate in the direction away from the other to increase the spaced relation therebetween to enable coins which have been held up on the runway to fall downwardly between the plates.

13. A coin processing device as claimed in Claim 12 in which the plates are spaced one from the other in parallel relation by an amount slightly greater but less than 0.015 inch to about 0.015 inch greater than the thickness of the coins adapted to pass between the respective portions of the plates.

14. A coin processing device as claimed in Claim 12 in which the runway has a downwardly inclined slope between 105-115° with the vertical.

15. A coin processing device as claimed in Claim 12 in which the taper in the surface of the runway is about 105-115°.

16. A coin processing device as claimed in Claim 12 in which the backing plate is disposed at an angle of 16-27° with the vertical.

17. A coin processing device as claimed in Claim 12 in which the backing plate extending from the runway upon which coins having the dimensional characteristics of a 25-cent piece are separated is disposed at an angle of 23-27° with the vertical.

18. A coin processing device as claimed in Claim 12 in which the backing plate, extending upwardly from a runway upon which coins having the dimensional characteristics of a 5-cent piece are separated, is disposed at an angle of 19-23° with the vertical.

19. A coin processing device as claimed in Claim 12 in which the backing plate, extending upwardly from a runway upon which coins having the dimensional characteristics of a 10-cent piece are separated, is disposed at an angle of 16-20° with the vertical.

20. A coin processing device as claimed in Claim 12 in which the backing plate is disposed at an angle of 16-27° with the vertical and the runway is formed with a taper of an angle of 105-115° with the vertical.

21. A coin processing device as claimed in Claim 1 in which the outwardly deformed portions in the other plate comprise a bulbous curvilinear portion having a curvature in the lower end portion calculated to dispose coins passing therethrough at an angle within the range of 49-55° with the vertical upon contact with the backing plate in alignment therewith.

22. A coin processing device as claimed in Claim 12 in which the one plate is formed with a curvilinear portion at the upper and lower edges of the displaced portions in the

one plate.

23. A coin processing device substantially as herein described with reference to the accompanying drawings.

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